421912

FLOOD INSURANCE STUDY

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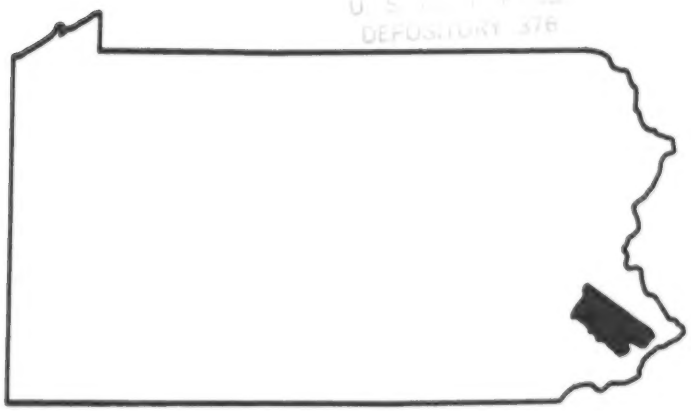
TOWNSHIP OF LIMERICK, PENNSYLVANIA
MONTGOMERY COUNTY



SEPTEMBER 16, 1980

federal emergency management agency
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COMMUNITY NUMBER - 421912

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FLOOD INSURANCE STUDY
TOWNSHIP OF LIMERICK, PENNSYLVANIA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Township of Limerick, Montgomery County, Pennsylvania, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert Limerick to the regular program of flood insurance by the Federal Insurance Administration (FIA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these federally-supported studies are based. These criteria take precedence over the minimum federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 24 CFR, 1910.1(d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were prepared by Pickering, Corts & Summerson, Inc. for the Federal Insurance Administration, under Contract No. H-4758. This study was completed in July 1979. Flood profiles and cross sections for the Schuylkill River were previously prepared in 1977 by Gannett, Fleming, Corddry and Carpenter, Inc.

1.3 Coordination

The streams to be studied were identified at the initial Consultation and Coordination Officer's (CCO) meeting attended by representatives of Pickering, Corts & Summerson, Inc. (the study contractor), the FIA, the Montgomery County Planning Commission (MCPC), and representatives of the Township of Limerick on May 4, 1978. Results of the hydrologic analyses were coordinated with the Delaware River Basin Commission (DRBC), and the U. S. Army Corps of Engineers (COE).

Aerial mapping was developed by Quinn and Associates, Inc. of Horsham, Pennsylvania.

On April 11, 1980, the results of the study were reviewed at the final CCO meeting attended by representatives of the study contractor, the FIA, and community officials.

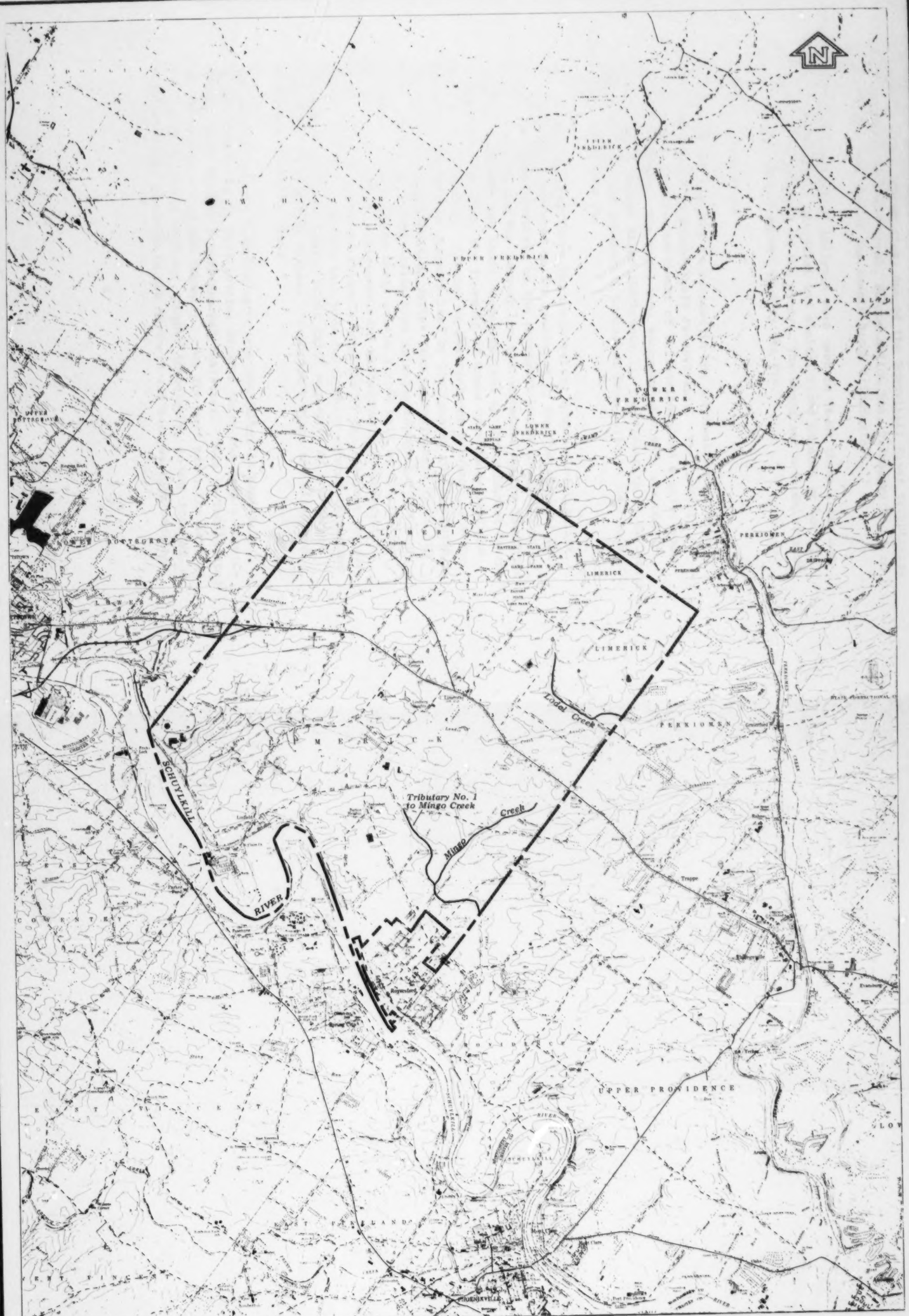
2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Township of Limerick, Montgomery County, Pennsylvania. Not studied was the Eastern State Game Land in the north-central part of the township. The area of study is shown on the Vicinity Map (Figure 1).

At the joint meeting of the MCPC, the FIA, the study contractor, and Limerick officials on May 4, 1978, it was agreed that the following streams would be studied in detail: the Schuylkill River, Mingo Creek, an unnamed tributary to Mingo Creek, herein designated Tributary No. 1 to Mingo Creek, and Lodal Creek. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction for the next five years, through July 1984.

The following streams were studied by approximate methods: a portion of Tributary No. 1 and two other unnamed tributaries to Mingo Creek, two tributaries to the Schuylkill River, a portion of Lodal Creek, a tributary to Lodal Creek, a portion of Mingo Creek, Brooke Evans Creek, Possum Hollow Run, Swamp Creek, a tributary to Swamp Creek, Hartenstine Creek, and its tributary, Landis Brook and two of its tributaries, and Mine Run. Negligible flood hazards were found to exist on the upper portions of six of these streams, and no flood



FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWNSHIP OF LIMERICK, PA
(MONTGOMERY CO.)

FIGURE 1

APPROXIMATE SCALE
6,000 0 6,000 12,000 18,000 FEET

VICINITY MAP

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boundaries were mapped for these portions. The streams were: one of the Mingo Creek tributaries, one of the Schuylkill River tributaries, the tributary to Lodal Creek, Possum Hollow Run, Tributary No. 1 to Mingo Creek, and one of the Landis Brook tributaries.

Approximate methods of analysis were used to study those areas having low development potential and minimal flood hazards as identified at the initiation of the study. The scope and methods of study were proposed to and agreed upon by the FIA.

2.2 Community Description

The Township of Limerick is located in the northwestern portion of Montgomery County in southeastern Pennsylvania. The township is approximately 27 miles northwest of Philadelphia and 6 miles southeast of Pottstown. The total area encompassed within its boundaries is 22.39 square miles (Reference 1). According to U. S. Census Bureau figures, the population increased from 5,110 in 1960 to 5,556 in 1970 (Reference 2).

The Schuylkill River forms the southwestern boundary of Limerick. The township is bordered on the southwest by the Townships of East Vincent and East Coventry, on the northwest by the Townships of Lower Pottsgrove and New Hanover, on the northeast by the Townships of Upper Frederick and Lower Frederick, and on the southeast by the Township of Perkiomen, the Township of Upper Providence, and the Borough of Royersford. Located in the Piedmont Province of Pennsylvania, Limerick is characterized by low, gently rolling terrain. The range in local elevation varies from approximately 95 to 500 feet. The major factor influencing existing topography has been erosion. In this region there exists a wide belt of distinctive red and gray shales, siltstones, and sandstones, characteristic of the lowland formed by Triassic deposits of the Piedmont physiographic province. Within this wide belt, which extends throughout the Schuylkill River basin, occur thick sequences of non-marine sediments, intruded by diabase ("traprock") dikes and sills and occasional basaltic flows.

The area within the Limerick corporate boundaries is basically rural, though in the past several decades there has been a considerable shift towards a more exurban character. This is facilitated by the topography of the township. For the most part, the land is flat or very gently rolling; rougher topography, in the form of rolling hills, is found in the northern and southwestern sections

of the township. There are numerous streams scattered throughout the township, most of which are small tributaries of the Schuylkill River, which forms the township's southwestern boundary. While much of the land is open, wooded areas generally are found in the stream valleys; in addition, there are several large wooded tracts in the northern sector of the township. Most of the open land in Limerick is still used for agricultural production (Reference 1).

The climate in southeastern Pennsylvania is milder than in other portions of the state. This is due primarily to the relatively low elevations and the protection offered by the mountainous areas to the north and west. Temperatures are characteristic of a prevailing temperate climate. Winter temperatures generally range from 10 degrees Fahrenheit (°F) to 50°F, with summer temperatures varying from 60°F to 100°F. The average annual precipitation of the area is 44.7 inches. Slightly over half of this amount falls in the warm season from April through September and is in the form of showers and thunderstorms. The recorded annual snowfall varies from 15 to 70 inches (Reference 3).

An estimated 10 percent of the township contains residential development. There are dispersed areas of commercial development along Ridge Pike in Linfield Village and around the Royersford area, near Limerick. Approximately 85 percent of the township is in agricultural, wooded or recreational use, with only limited development in the flood plain areas. Major highways in the township include U. S. Route 422 and the Schuylkill Expressway Extension. Conrail roughly parallels the Schuylkill River through the township.

The Limerick Nuclear Power Plant is under construction in the township near the Schuylkill River.

The Schuylkill River, a major tributary of the Delaware River, is 130 miles long, and has a total drainage area of 1,920 square miles. The average stream gradient is 2.6 feet per mile.

Mingo Creek is a tributary of the Schuylkill River. It is 3.5 miles long, with a drainage area of 7.9 square miles. The average bottom gradient within the study portion is 43 feet per mile.

Tributary No. 1 to Mingo Creek has a drainage area of 1.1 square miles. The length studied in detail is 0.7 mile and the average bottom gradient within the portion being studied is 42 feet per mile.

Lodal Creek is a tributary to Perkiomen Creek. It is 5.7 miles long, with a drainage basin of 5.1 square miles. The average bottom gradient within the detailed-study segment is 43 feet per mile.

2.3 Principal Flood Problems

The past history of flooding on the Schuylkill River, Mingo Creek, Tributary No. 1 to Mingo Creek, and Lodal Creek indicates that major flooding in Limerick may occur during any season of the year. Most of the major floods have occurred during the spring and summer months. These floods are usually associated with tropical storms moving up the Atlantic coastline.

There have been a number of major floods on the Schuylkill River during this century, the most noteworthy of which occurred in 1933, 1955, and 1972. These floods damaged private and public properties adjacent to the river in the Township of Limerick. For the 1933 flood, the Pottstown gaging station approximately 6 miles upstream of Limerick recorded a discharge of 47,800 cubic feet per second (cfs). At the Philadelphia gaging station, located 39 miles downstream of the township, the Schuylkill River discharge was 96,200 cfs. For the 1955 flood, the peak discharges for these stations were 43,300 cfs and 90,100 cfs, respectively.

During the flood from Tropical Storm Agnes (June 14-23, 1972), the Schuylkill River attained its highest recorded peak discharge. At the Pottstown gaging station, the computed discharge was 95,900 cfs, while at the Philadelphia gage the peak discharge recorded was 103,000 cfs. The estimated 100-year Schuylkill River flood discharge in Limerick is 80,150 cfs. The elevation of a high-water mark from Tropical Storm Agnes located 0.2 mile downstream of Vincent Dam on the Schuylkill River is 124.9 feet, compared to the elevation of the 100-year flood at this location, which is 122.3 feet, or 2.6 feet below that of the Agnes flood.

The length of record of the Pottstown gaging station is 53 years, while that of the Philadelphia station is 48 years (References 4 and 5).

The estimated 100-year flood discharge for Mingo Creek is 3,770 cfs. The estimated 100-year flood discharge for Tributary No. 1 to Mingo Creek is 1,480 cfs, for Lodal Creek, it is 3,340 cfs. No high-water marks are known to exist within the study area for Mingo Creek, Tributary No. 1 to Mingo Creek, or Lodal Creek.

2.4 Flood Protection Measures

Blue Marsh Dam and Reservoir is a multipurpose reservoir located in Berks County, Pennsylvania, on Tulpehocken Creek, a tributary of the Schuylkill River. The reservoir site is about 6 miles northwest of Reading, Pennsylvania. The 100-foot high, earthfill dam will provide some flood protection to the downstream area. Blue Marsh Dam and Reservoir provides flood storage of 32,400 acre-feet, which will decrease downstream flood flows in Tulpehocken Creek and in the Schuylkill River (Reference 4).

However, the flood-flow reduction that would result from the flood storage provided by Blue Marsh Dam and Reservoir has not been considered in this study, because hydrologic analyses which included the flood-flow reduction did not produce significantly lower discharge estimates that would warrant the time and cost involved in revising previously completed Flood Insurance Studies along the Schuylkill River.

At present, there are no flood protection structures within the township itself. The Vincent Dam on the Schuylkill River and the adjacent levees offer no flood protection for Limerick but are used in conjunction with the Schuylkill Canal. However, there are non-structural measures of flood protection in use to prevent future flood damage in the form of land use regulations intended to control construction within areas that have a high risk of flooding.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one-percent chance of annual occurrence) in any 50-year period is about

40 percent (four in ten) and, for any 90-year period, the risk increases to about 60 percent (six in ten). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail affecting the community.

Recorded discharge-frequency data for the Schuylkill River were based on a statistical analysis of discharge records covering a 49-year period at the Pottstown gaging station and a 44-year period at the Philadelphia gaging station, both operated by the U. S. Geological Survey (USGS) (References 4, 5, and 6). This analysis followed the standard log-Pearson Type III method outlined by the Water Resources Council (References 7 and 8). Results were compared with available discharge-frequency data published by the USGS, the COE, and the DRBC.

For the detailed study of Mingo Creek, Tributary No. 1 to Mingo Creek, and Lodal Creek, the hydrologic analyses were performed following a methodology which relates drainage basin characteristics to streamflow characteristics (Reference 9). The streamflow discharges determined using this methodology compared favorably with streamflow discharges computed using the methodology contained in a regional frequency study by the COE on the upper Delaware and Hudson River Basins (Reference 10).

The regression model for streams similar to those in Limerick is based upon ten gaging stations, and relates the magnitude of instantaneous peak stream discharge for selected recurrence intervals to statistically significant drainage-basin characteristics. These drainage-basin characteristics include the drainage area as determined from detailed topographic maps (Reference 11), channel slope, storage, and annual precipitation.

Table 1 provides a summary of the peak discharge-drainage area relationships for the streams studied by detailed methods.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
SCHUYLKILL RIVER					
At downstream corporate limits	1,196.3	42,300	67,700	80,150	121,450
At East Vincent/East Coventry township boundary	1,173.6	41,800	66,950	79,100	119,900
At upstream corporate limits	1,167.5	41,650	66,750	78,850	119,500
MINGO CREEK					
At downstream corporate limits	4.4	1,550	2,950	3,770	5,720
Upstream of Walnut Street	3.5	1,290	2,440	3,120	4,730
Upstream of Tributary No. 1 to Mingo Creek	1.6	690	1,290	1,640	2,450
Downstream of Linfield Road	1.1	510	950	1,200	1,790
TRIBUTARY NO. 1 TO MINGO CREEK					
At confluence with Mingo Creek	1.1	600	1,150	1,480	2,280
LODAL CREEK					
At downstream corporate limits	3.8	1,380	2,620	3,340	5,060
Upstream of Graterford Road	1.1	510	950	1,200	1,790

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in detail were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of these flooding sources.

Cross sections for the backwater analysis for the streams studied in detail were obtained from aerial photographs taken in February 1973 and January 1979 (Reference 12). Stream bed sections were obtained by field measurement. All bridges, dams, and culverts

were surveyed to obtain elevation data and structural geometry in order to compute the significant backwater effects of these structures. Cross sections were located above and below bridges, at control locations along the stream lengths, and at significant changes in ground relief, land use, or land cover.

Water-surface elevations were computed through use of the COE HEC-2 step-backwater computer program (Reference 13) for all streams studied in detail, except for the downstream reach of the Schuylkill River. Water-surface profiles, hydrology, floodway data, zone data, and flood boundaries for this portion of the Schuylkill River were obtained from the Flood Insurance Study for the Township of East Vincent (Reference 14).

Starting water-surface elevations for Mingo Creek and Lodal Creek were calculated using the slope/area method. Starting water-surface elevations for Tributary No. 1 to Mingo Creek were based on coincidental peak flow elevations at the Mingo Creek confluence.

Starting water-surface elevations for the Schuylkill River were taken from the flood profiles prepared for the DRBC (Reference 15). These elevations were developed using USGS gage and rating table data from the Philadelphia gage (References 4, 5, and 7).

Roughness coefficients (Manning's "n") for these computations were assigned on the basis of field inspection of flood plain areas and comparisons with data on other nearby basins. The range of roughness values for each stream studied in detail is as follows:

	Channel "n"	Overbank "n"
Schuylkill River	0.024-0.050	0.045-0.120
Mingo Creek	0.040-0.040	0.055-0.080
Tributary No. 1 to Mingo Creek	0.035-0.040	0.050-0.060
Lodal Creek	0.040-0.040	0.055-0.080

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals. Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway is computed (Section 4.2), selected cross-section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 3).

All elevations used in this study are referenced to the National Geodetic Vertical Datum of 1929 (NGVD), formerly referred to as Sea Level Datum of 1929. Locations of the elevation reference marks used in the study are shown on the maps.

The hydraulic analyses for this study are based on the effects of unobstructed flow. The flood elevations shown on the profiles are valid only if hydraulic structures remain unobstructed and do not fail.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FIA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100- and 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:2,400 with a contour interval of 5 feet (Reference 16). In cases where the 100- and 500-year flood boundaries are close together, only the 100-year boundary has been shown.

For the approximate-study streams (two tributaries to Mingo Creek, two tributaries to the Schuylkill River, a tributary to Lodal Creek, part of Mingo Creek, Brooke Evans Creek, Possum Hollow Run, Swamp Creek, the Tributary to Swamp Creek, Hartenstine Creek, the Tributary to Hartenstine Creek, Landis Brook, two tributaries to Landis Brook, and Mine Run), the 100-year flood boundaries were delineated using field inspection of the area, engineering judgment, examination of available topographic mapping, and the Flood Hazard Boundary Map for the Township of Limerick (Reference 17). The effects of bridges, culverts, and other constructions were also considered.

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 3). Small areas within the flood

boundaries may lie above the flood elevations and, therefore, may not be subject to flooding. Owing to limitations of the map scale and lack of detailed topographic data, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood can be carried without substantial increases in flood heights. Minimum standards of the FIA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this report are presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plains. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 2).

As shown on the Flood Boundary and Floodway Map (Exhibit 3), the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown. Portions of the floodway widths computed for the Schuylkill River lie outside the Limerick corporate limits.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Schuylkill River								
A	970	832	17,583	4.6	118.2	118.2	119.1	0.9
B	2,035	950	19,515	4.1	118.6	118.6	119.4	0.8
C	2,980	920	16,534	4.8	118.7	118.7	119.6	0.9
D	4,160	855	16,719	4.8	119.1	119.1	120.0	0.9
E	5,140	515	11,047	7.3	119.3	119.3	120.1	0.8
F	5,590	443	10,582	7.5	119.4	119.4	120.3	0.9
G	6,020	451	10,192	7.8	119.6	119.6	120.5	0.9
H	7,105	515	10,827	7.4	120.4	120.4	121.3	0.9
I	8,020	415	9,001	8.9	120.8	120.8	121.7	0.9
J	9,000	507	10,755	7.4	122.0	122.0	122.8	0.8
K	10,110	705	15,757	5.1	123.2	123.2	124.0	0.8
L	10,985	745	15,825	5.0	124.1	124.1	125.0	0.9
M	11,585	735	15,673	5.1	124.3	124.3	125.2	0.9
N	12,600	798	15,839	5.0	124.6	124.6	125.5	0.9
O	13,495	815	16,559	4.8	124.9	124.9	125.8	0.9
P	14,625	647	14,108	5.7	125.2	125.2	126.1	0.9
Q	15,705	677	14,667	5.4	125.6	125.6	126.5	0.9
R	16,770	758	18,010	4.4	126.2	126.2	127.1	0.9
S	17,840	863	19,782	4.0	126.5	126.5	127.4	0.9

[1] Feet above corporate limits
[2] This width extends beyond corporate limits

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWNSHIP OF LIMERICK, PA
(MONTGOMERY CO.)

FLOODWAY DATA

SCHUYLKILL RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Schuylkill River (continued)								
T	18,755	915[2]	20,035	4.0	126.7	126.7	127.6	0.9
U	19,140	912[2]	19,788	4.0	126.8	126.8	127.7	0.9
V	19,800	1,000[2]	23,019	3.5	127.0	127.0	127.9	0.9
W	20,300	790[2]	16,999	4.7	127.2	127.2	128.1	0.9
X	22,450	623[2]	15,962	5.0	128.2	128.2	129.1	0.9
Y	23,490	805[2]	17,472	4.5	128.2	128.2	129.1	0.9
Z	24,470	940[2]	19,132	4.1	128.3	128.3	129.2	0.9
AA	25,495	990[2]	19,723	4.0	128.5	128.5	129.5	1.0
AB	26,495	840[2]	17,532	4.5	128.7	128.7	129.6	0.9
AC	27,565	800[2]	16,977	4.6	129.0	129.0	129.9	0.9
AD	28,525	700[2]	14,441	5.5	129.1	129.1	130.0	0.9
AE	29,485	567[2]	11,123	7.1	129.1	129.1	130.1	1.0
Mingo Creek								
A	120	90	489	7.7	149.9	149.9	150.7	0.8
B	780	140	760	4.1	153.5	153.5	154.0	0.5
C	1,724	122	934	3.3	159.1	159.1	159.1	0.0
D	2,484	57	382	8.2	159.5	159.5	159.8	0.3

[1] Feet above corporate limits
[2] This width extends beyond corporate limits

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWNSHIP OF LIMERICK, PA
(MONTGOMERY CO.)

FLOODWAY DATA

SCHUYLKILL RIVER AND MINGO CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Mingo Creek (continued)								
E	3,340[1]	68	555	5.6	163.5	163.5	163.5	0.0
F	3,972[1]	175	853	3.7	164.3	164.3	164.6	0.3
G	5,012[1]	156	362	4.5	166.4	166.4	167.0	0.6
H	6,432[1]	50	216	7.6	176.5	176.5	176.5	0.0
I	7,422[1]	78	254	6.5	183.6	183.6	184.4	0.8
J	8,572[1]	93	307	3.9	190.0	190.0	190.0	0.0
K	10,082[1]	140	543	2.2	198.3	198.3	198.6	0.3
L	10,842[1]	90	190	6.3	200.0	200.0	200.0	0.0
Tributary No. 1 to Mingo Creek								
A	620[2]	103	319	4.6	166.1	166.1	167.1	1.0
B	1,140[2]	145	247	4.9	170.7	170.7	170.7	0.0
C	1,640[2]	170	865	1.4	171.8	171.8	172.0	0.2
D	1,960[2]	43	122	9.8	173.3	173.3	173.3	0.0
E	2,670[2]	37	154	7.8	179.4	179.4	180.0	0.6
F	3,220[2]	35	122	9.8	184.5	184.5	184.8	0.3
G	3,773[2]	53	307	3.9	193.6	193.6	193.6	0.0

[1] Feet above corporate limits
[2] Feet above confluence with Mingo Creek

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWNSHIP OF LIMERICK, PA
(MONTGOMERY CO.)

FLOODWAY DATA

MINGO CREEK AND TRIBUTARY NO. 1 TO MINGO CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Lodal Creek								
A	70	100	624	5.3	204.8	204.8	204.9	0.1
B	1,110	100	351	9.5	209.1	209.1	209.8	0.7
C	1,965	245	1,247	2.7	216.4	216.4	217.1	0.7
D	2,695	25	103	11.6	219.8	219.8	220.1	0.3

[1]Feet above corporate limits

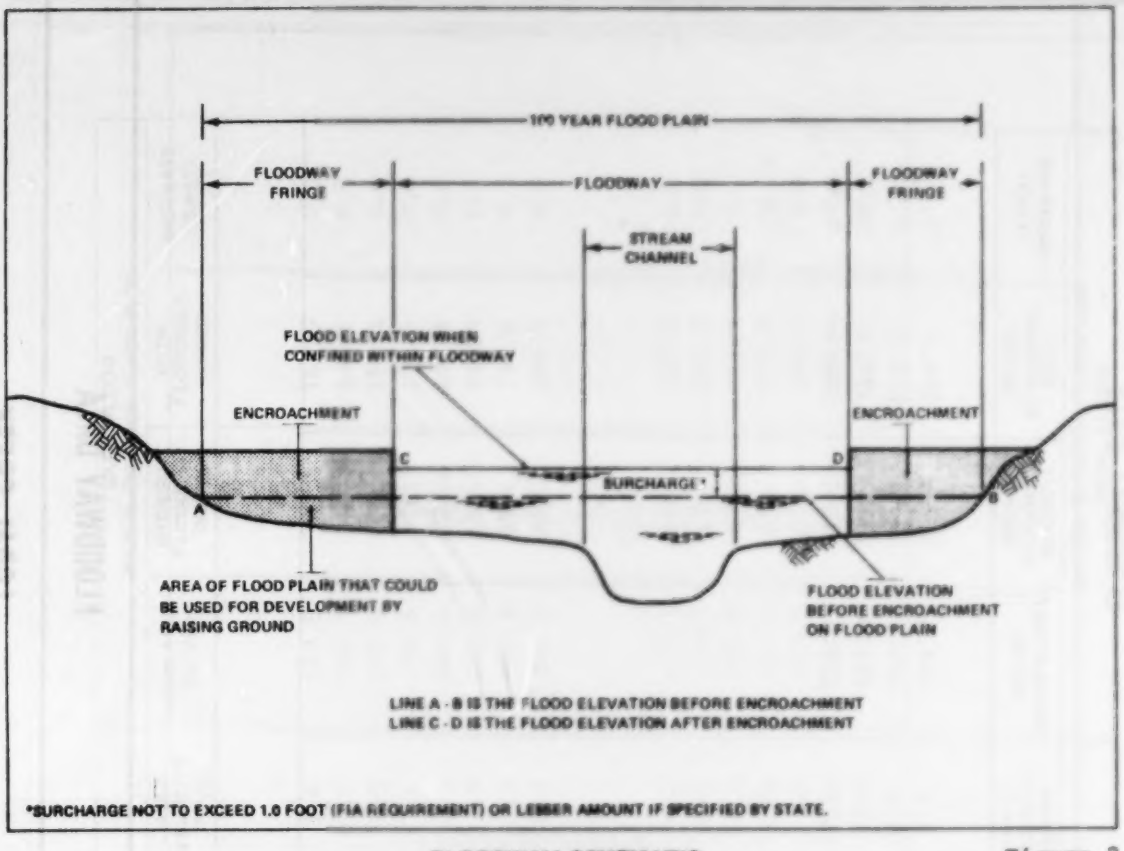
TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWNSHIP OF LIMERICK, PA
(MONTGOMERY CO.)

FLOODWAY DATA

LODAL CREEK


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FIA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FLOODWAY SCHEMATIC Figure 2

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FIA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHFs), and flood insurance zone designations for each flooding source affecting the Township of Limerick.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the flooding sources of the Township of Limerick are shown on the Flood Profiles (Exhibit 1) and are summarized in the Flood Insurance Zone Data Table (Table 3).

5.2 Flood Hazard Factors

The FHF is the FIA device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest 0.5 foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of the Township of Limerick was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.
Zones A3, A4, A7, A8, A15:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to FHF.

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Schuylkill River							
Reach 1	01, 04, 07	-7.5	-2.3	+7.3	075	A15	Varies
Mingo Creek							
Reach 1	07	-2.1	-0.8	+1.7	020	A4	Varies
Reach 2	07	-4.0	-1.4	+3.0	040	A8	Varies
Reach 3	07, 08	-1.6	-0.5	+0.9	015	A3	Varies
Tributary No. 1 to Mingo Creek							
Reach 1	07	-1.3	-0.4	+0.7	015	A3	Varies
Lodal Creek							
Reach 1	08	-3.7	-0.8	+1.4	035	A7	Varies
Reach 2	08	-1.3	-0.4	+0.8	015	A3	Varies

[1]Flood Insurance Rate Map Panel
[2]Weighted average
[3]Rounded to the nearest foot - see map

TABLE

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWNSHIP OF LIMERICK, PA

FLOOD INSURANCE ZONE DATA

SCHUYLKILL RIVER, MINGO CREEK

TRIBUTARY NO. 1 TO MINGO CREEK AND LODAL CREEK

Zone B: Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; also, areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.

Zone C: Areas of minimal flooding.

Zone D: Areas of undetermined but possible flood hazard.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevations for the flooding sources studied in detail in the township.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Township of Limerick is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FIA.

6.0 OTHER STUDIES

A report published by the USGS in September 1973 entitled Extent and Frequency of Floods on the Schuylkill River Near Phoenixville and Pottstown, Pennsylvania, presents water-surface profiles with associated flood discharges for the Schuylkill River, plotted from high-water marks of selected historical floods that occurred during the period 1933 to 1972 (Reference 18). The resulting profiles, plotted from data obtained from local residents and government agencies, were used here to provide background information only, since the more updated hydrologic and hydraulic methods used in the present report do not allow for the comparison of results.

Another report published in August 1974 entitled Hydrologic Data of the June 1972 Flood in Pennsylvania (Reference 19) also contains water-surface profiles with associated flood discharges for the Schuylkill River. Profiles were plotted from surveyed high-water marks taken during Tropical Storm Agnes in June 1972. The Agnes profiles and discharges were used as a guide to adjust the hydraulic parameters along the Schuylkill River before computing the 10-, 50-, 100-, and 500-year discharges and profiles for the present study.

Flood Insurance Studies are underway for the following communities adjacent to Limerick: the Borough of Royersford and the Townships of Lower Pottsgrove, New Hanover, Upper Frederick, Perkiomen, and East Coventry (References 20, 21, 22, 23, 24, and 25). Studies have been published for the Townships of East Vincent, Upper Providence, and Lower Frederick (References 14, 26, and 27). Data used in the present study have been compared and coordinated with that of the other studies, to ensure agreement of results across common borders.

This study is authoritative for purposes of the Flood Insurance Program, and the data presented here either supersede or are compatible with previous determinations.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the office of the Insurance and Mitigation Division of the Federal Emergency Management Agency, Regional Director, Region III Office, Curtis Building, Sixth and Walnut Streets, Philadelphia, Pennsylvania 19106.

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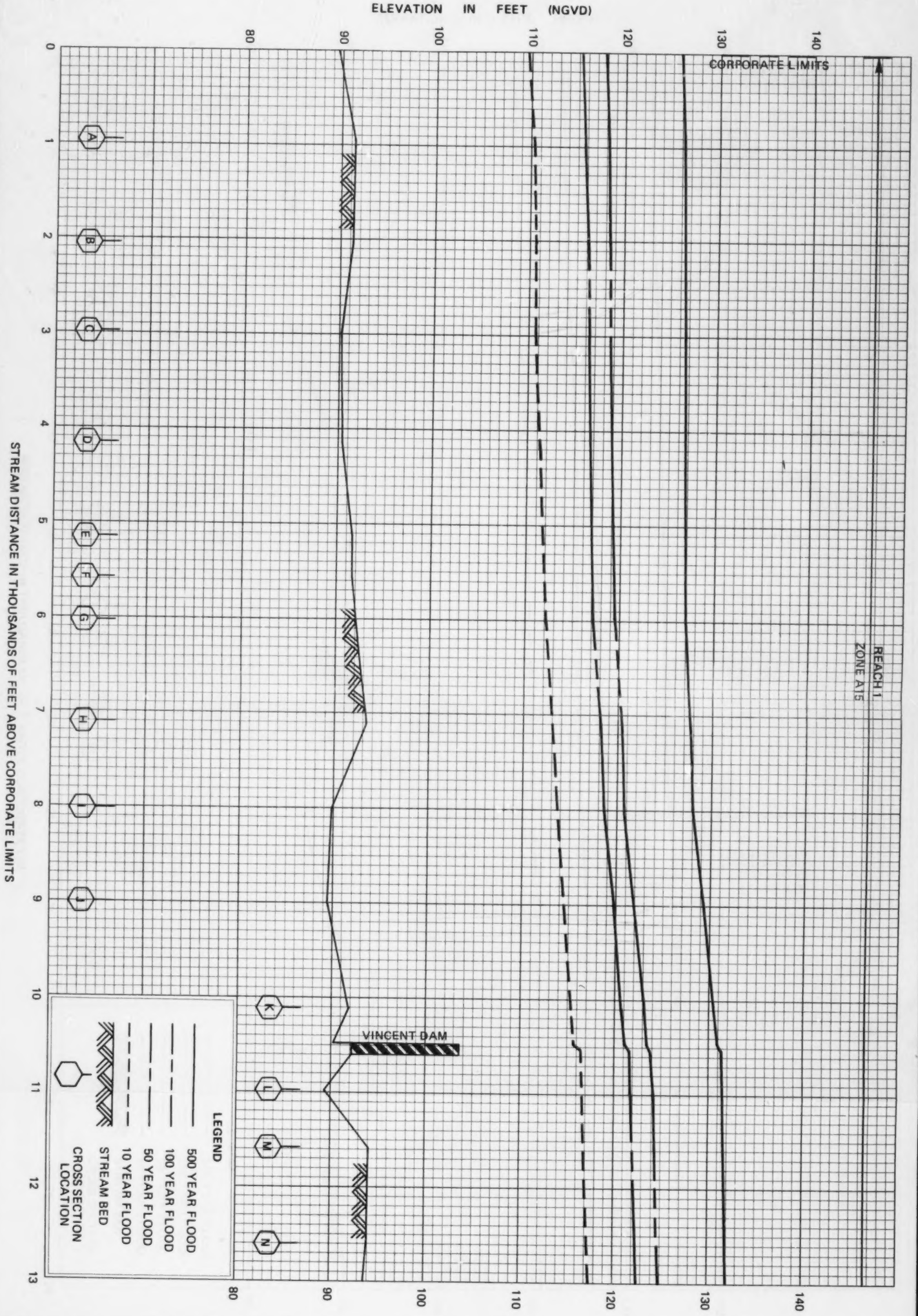


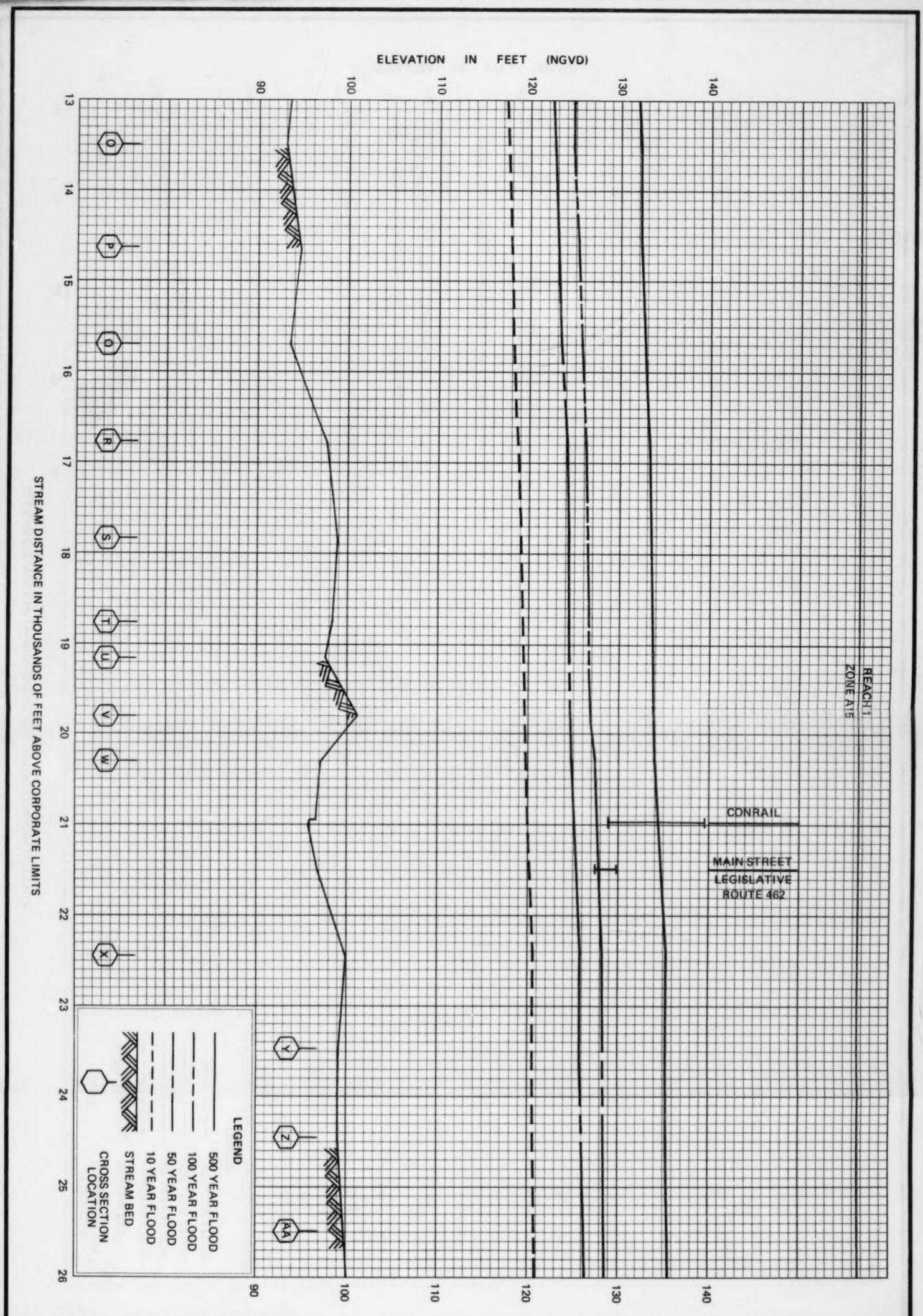
FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWNSHIP OF LIMERICK, PA
(MONTGOMERY CO.)

FLOOD PROFILES

SCHUYLKILL RIVER

01P



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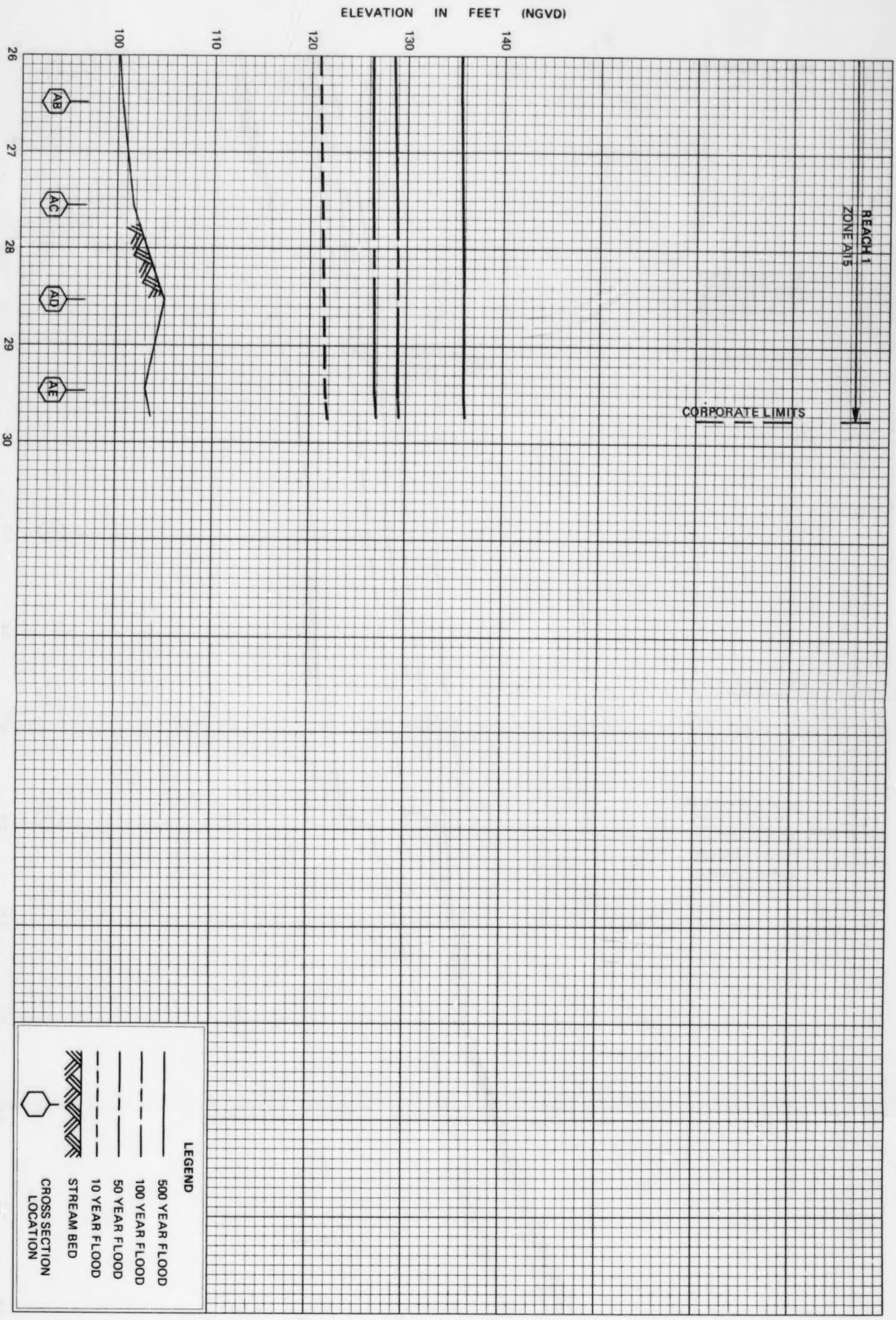
FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWNSHIP OF LIMERICK, PA
(MONTGOMERY CO.)

FLOOD PROFILES

SCHUYLKILL RIVER



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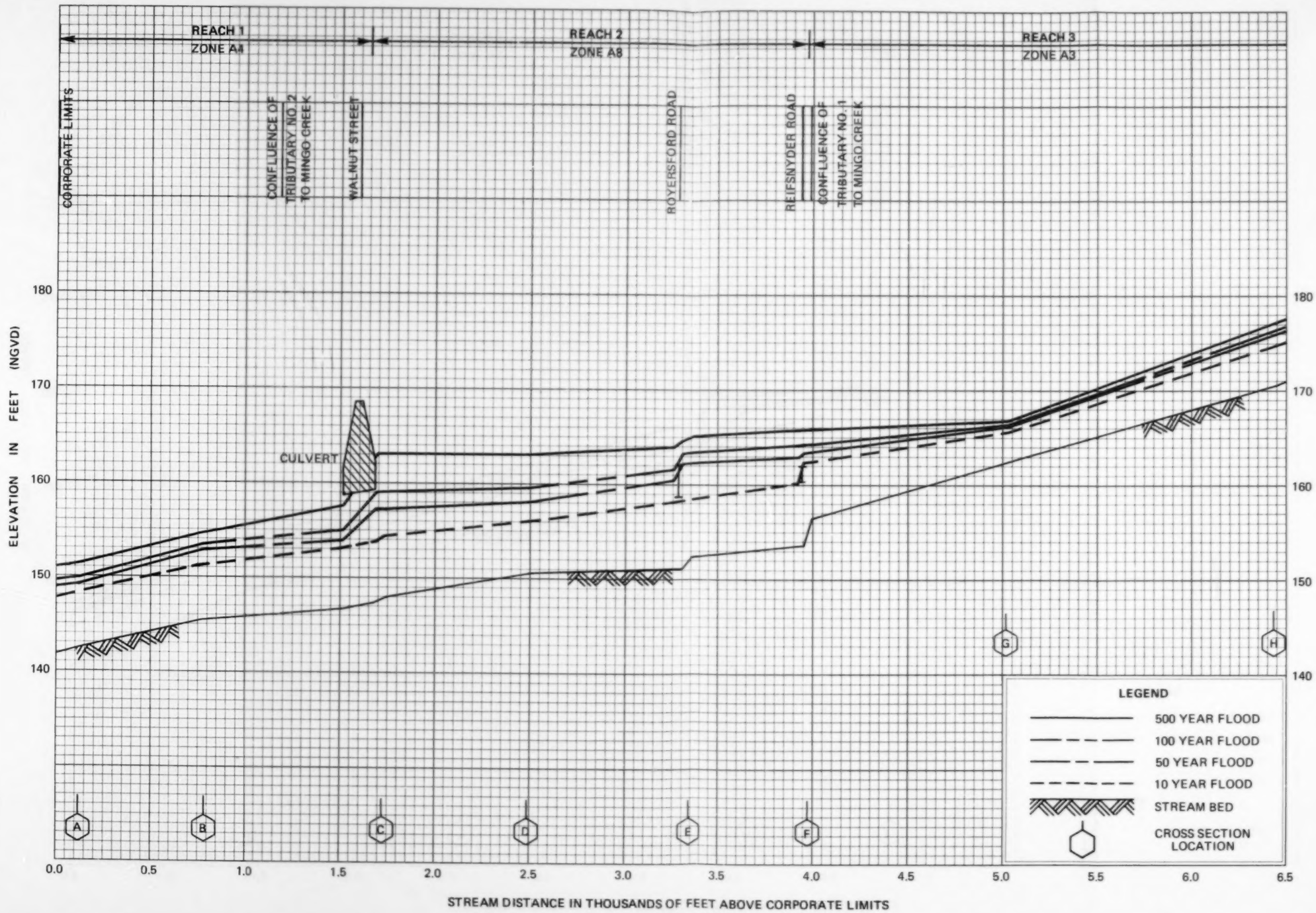

FLOOD PROFILES

MINGO CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWNSHIP OF LIMERICK, PA
(MONTGOMERY CO.)

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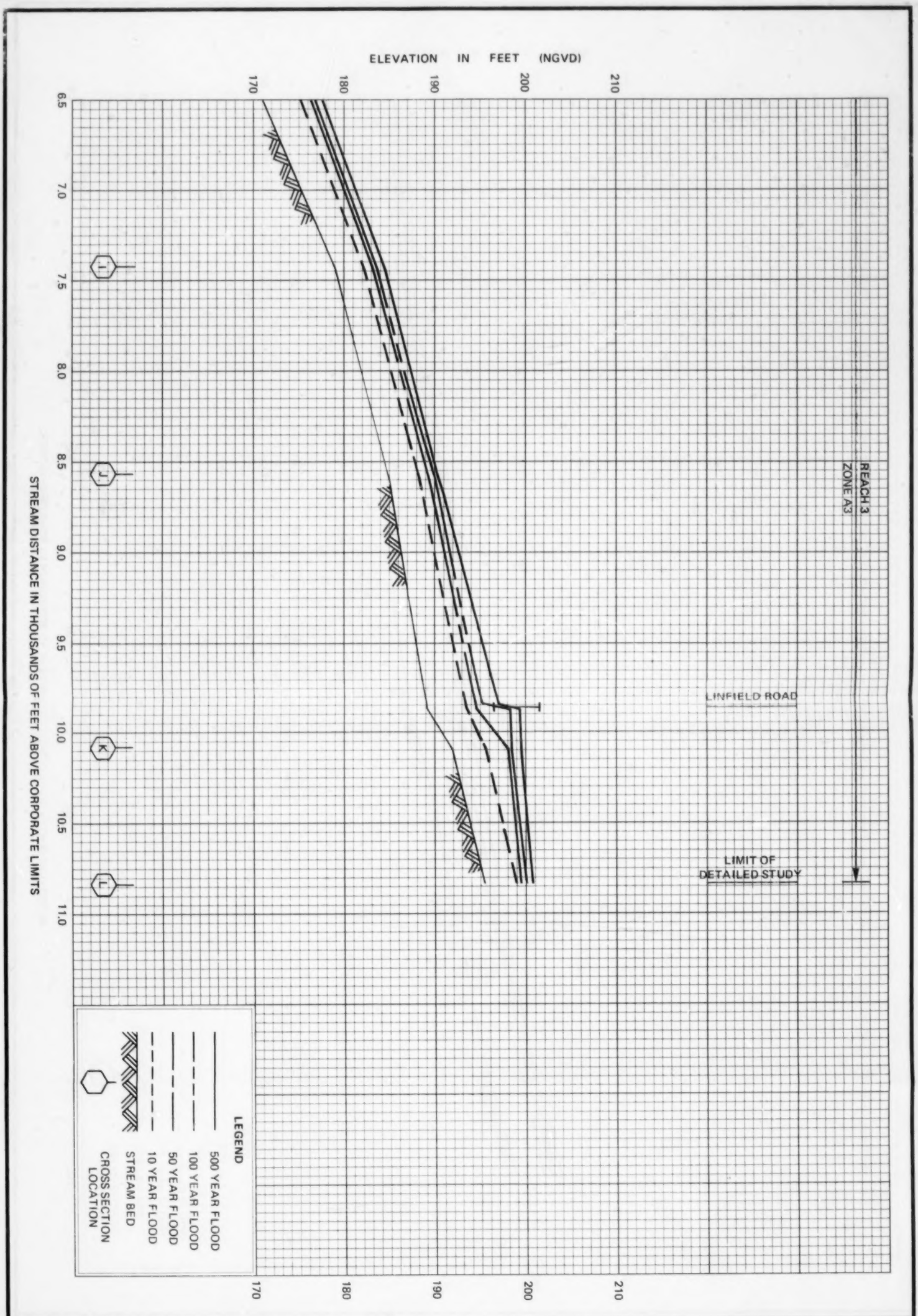

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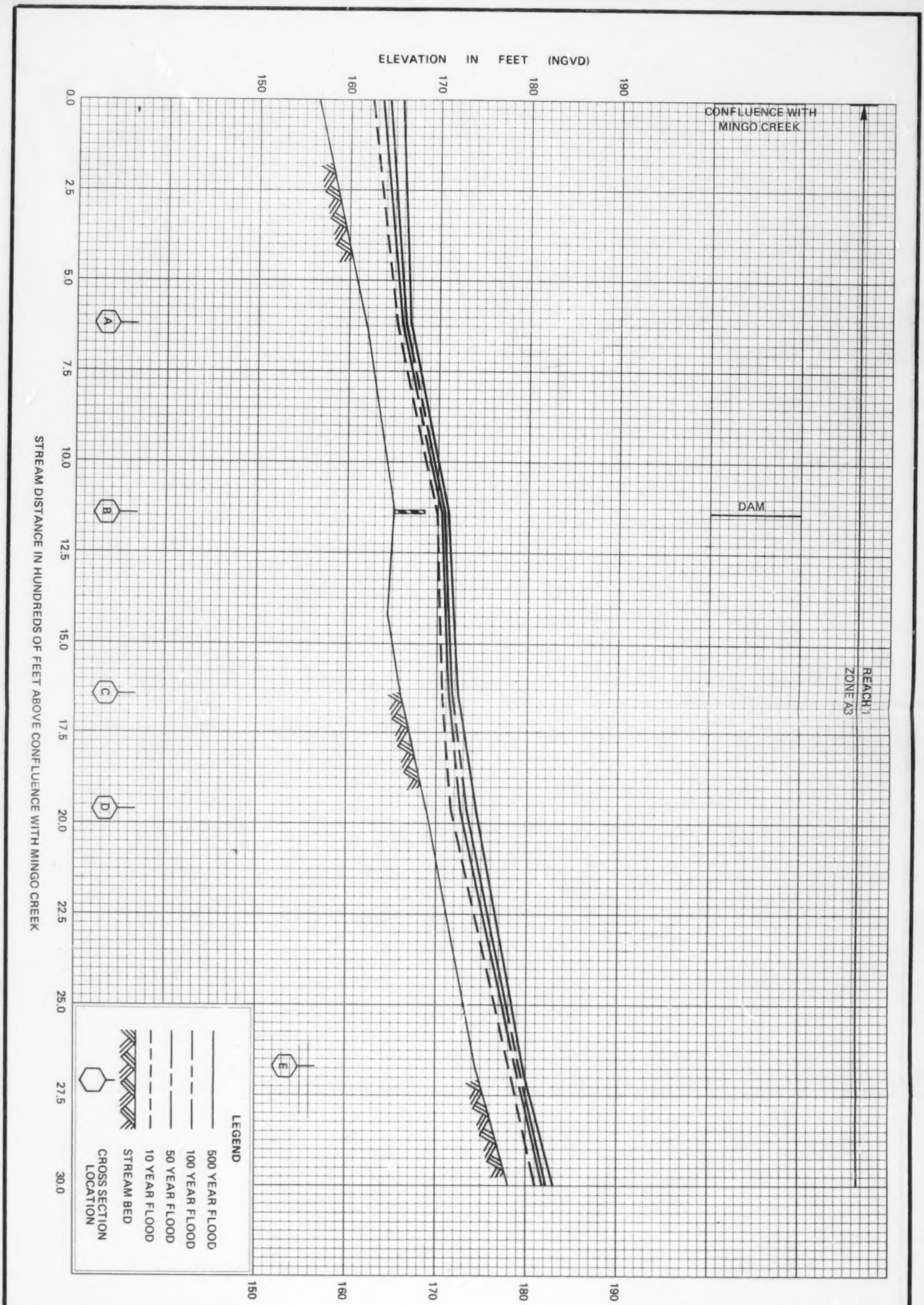
FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWNSHIP OF LIMERICK, PA
(MONTGOMERY CO.)

FLOOD PROFILES

MINGO CREEK



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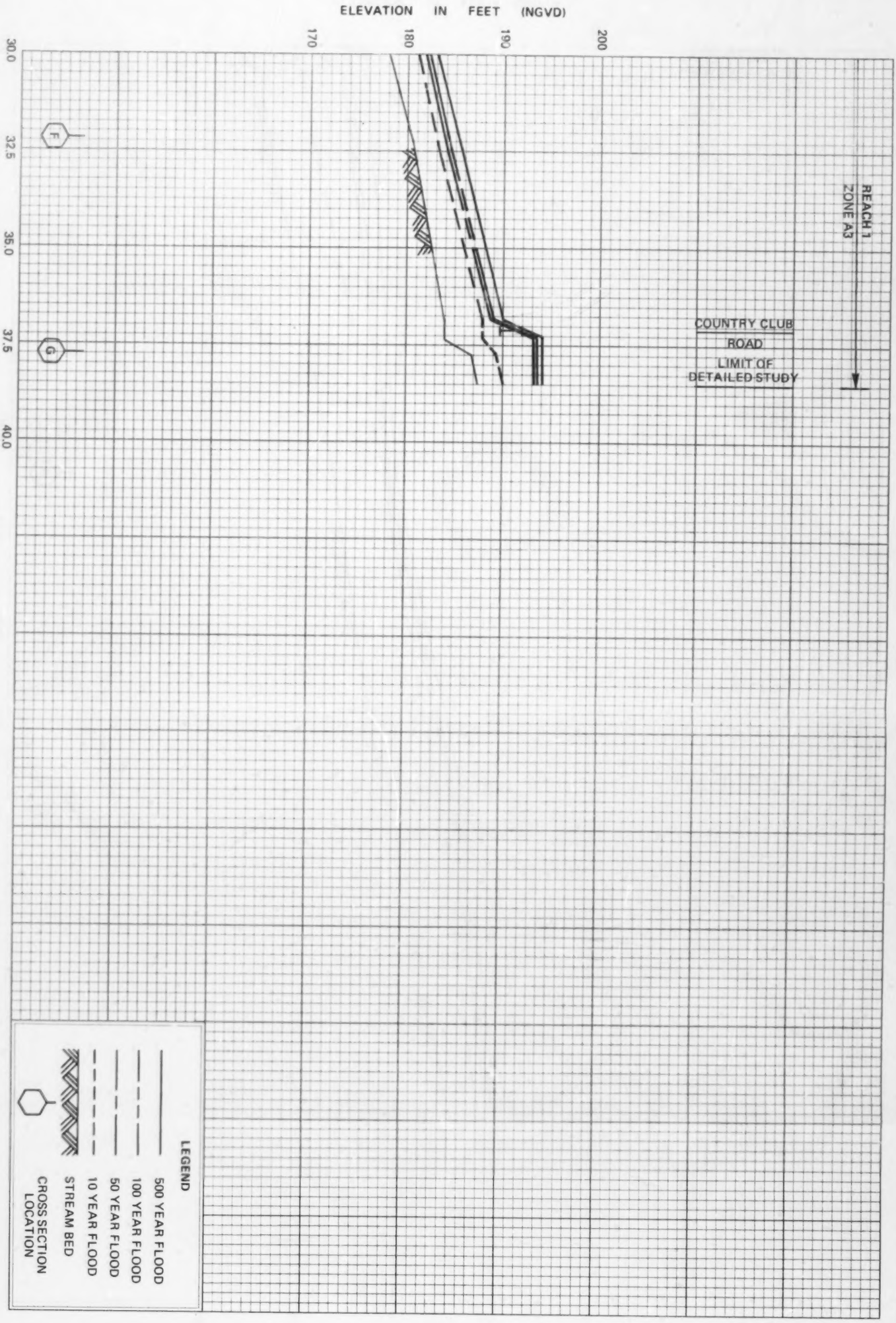
FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWNSHIP OF LIMERICK, PA
(MONTGOMERY CO.)

FLOOD PROFILES

TRIBUTARY NO. 1 TO MINGO CREEK



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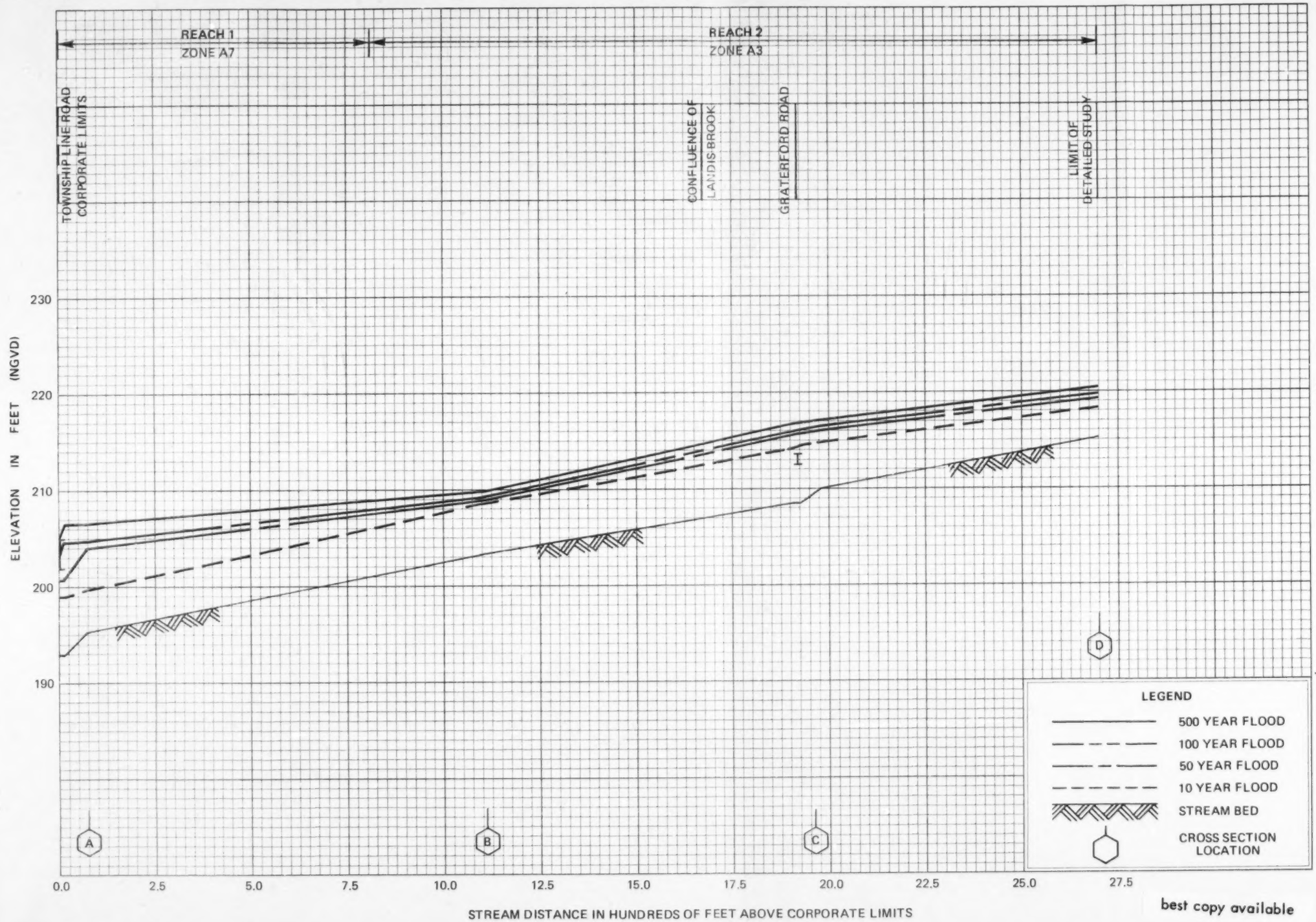
FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWNSHIP OF LIMERICK, PA
(MONTGOMERY CO.)

FLOOD PROFILES

TRIBUTARY NO. 1 TO MINGO CREEK



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FLOOD PROFILES

LODAL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWNSHIP OF LIMERICK, PA
(MONTGOMERY CO.)

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